ETA® International
FIBER OPTICS INSTALLER CERTIFICATION
SUPPLEMENTAL STUDY PACKAGE
(For U.S. Military Personnel)

EXAM FEE - $150.00

The ETA® International and the US Military

The Electronics Technicians Association, International (**ETA®**) has offered its certification programs to the US Military for over 14 years. Most US military personnel are under the impression that civilian industries, civilian companies and their Human Resource Departments (those that do the hiring) understand how military training relates to civilian job requirements. Separating US military personnel often go to job interviews and submit resumes listing military training schools and military job experience and expect that civilian employers know what positions military training and job experience qualifies them for. Nothing could be further from the truth! During the last two decades, changes in the civilian electronics industry and changes in the US military training programs (computers and computer networking, data transference methods, fiber optics, wireless communications, satellite technologies, customer service requirements, etc.) have widened the "understanding gap" between civilian employers and military-trained personnel. Military training has always been regarded as the "best in the world" when it comes to new technologies, but the best way to relate your military training to civilian jobs and industries has always been through **ETA® International** certifications. Here's why:

ETA® certification programs are exactly the same for both civilian and US military personnel. US military personnel take the same **ETA®** exams, with the same requirements and earn the same industry certifications as their civilian counterparts. Military personnel are tested on the same civilian industry standards and operating procedures that are used to separate those who "qualify" as professional technicians on the outside and those who do not. There are subtle but distinct differences in military training and civilian technical school training programs because military personnel work with the same technologies and equipment as their civilian counterparts, but the specific applications and standards sometimes differ. Those US military personnel that do earn **ETA®** certification have "gone the extra mile" by demonstrating that not only have they been trained thoroughly in their field by expert military instructors, they have learned how to apply their training to the demands of civilian standards and civilian applications as well. To accomplish these civilian-equivalency certification goals, US military personnel must not only study the required course materials which include military standards and application requirements, they must also learn how to apply them to the civilian industry standards and applications that make them an industry-wide and universally accepted professional.

ETA® Certification is not just for separating US military personnel, it is for every US military personnel that wants to be recognized as a professional. **ETA®** certifications test your ability to "stand with the best" and prove that your knowledge and skills are on a par with **anyone**. As a US military member, we are well aware of the sacrifices you must make every day to ensure the freedom of every American while serving all of us. The **ETA®** offers our programs to you with the hope that you will convert the great military training you have received into meaningful **ETA®** Professional Certifications.

The ETA® International Fiber Optics Installer Certification Program

The **ETA® Fiber Optics Installer Certification** is proof positive that you have been thoroughly trained and can demonstrate the highest professional fiber optics installation proficiency. Many employers in the electronics industry require their technicians to hold an **ETA®** Certification as a condition of employment. The **ETA® Fiber Optics Installer Certification** is a widely recognized and respected addition to any resume and will assist you in achieving your goal of a career in electronics or telecommunications. By earning "**ETA®** Certification", you have successfully completed the most advanced and comprehensive certification program in the world's fastest growing field: Fiber Optics Installation. Your successful completion of this program means you now have the knowledge and "hands-on" skills necessary to be regarded as a **Certified Fiber Optics Installer**. Your certification is for a full 4 years from the date of issue and confers upon you all of the professional recognition worthy of a technician in the field of fiber optics installation.

Your **FOIC** is evidence from the Electronics Technicians Association, International **(ETA®)**, the international organization that certifies technicians in all fields, that you have what it takes to install, splice, and connectorize complex fiber optics cable. (*NOTE: The military does not perform mechanical and/or fusion splicing. If the cable assembly breaks, they replace the whole cable assembly*.) As a testament to your professional achievement, your certification issued by the **ETA®** is valid for a full 4-year period and may be renewed at the end of this period upon meeting specified recertification criteria established by the **ETA®**.

This Supplement Is NOT A "Stand-Alone" Study Guide

The 75-question **ETA®** Fiber Optics Installer Certification Examination that you will be attempting is very difficult and requires a concentrated study of your military-provided fiber optics training course materials and this Supplemental Study Package. Course materials provided to you by **ETA®** approved training schools are essential in that they provide the theory, techniques, and other key elements required to successfully pass the **ETA®** examination. This Supplemental Study Guide is not meant to be a "stand-alone" item.

A good reference source (in addition to your military course study materials and this supplemental package) is the book entitled, "Technician's Guide To Fiber Optics, Fourth Edition", by Donald J. Sterling, Jr., Delmar Publishers, Inc., Copyright 2004, ISBN 1401812708. Preparation for the **ETA®** examination requires you to study all available materials to ensure successful results. When you are prepared to take the **ETA®** Fiber Optics Installer Certification Examination, read carefully and fill out the application on the last page of this document & present it to a Military Testing Center with your required military ID, course completion certificate or service jacket entry.

Theory:

1. **The physical structure of optical fiber**
   a) **Identify the core, cladding and coating of an optical fiber**
   b) **Identify the core/cladding diameters (ratios) of single mode and multi-mode optical fibers**

2. **Light propagation through optical fibers**
   a) **Loss in an optical fiber (called attenuation) can be measured by what type of test equipment and methods?**
   b) **A light path in optical fibers (also called a mode) is generated by what two types of light sources? What type of light source is used in single mode fibers? In multimode fibers?**
   c) **How is power in an optical fiber specified? (What unit of measurement is used?)**
   d) **What are the common wavelengths used for LAN and long distance communications through optical fiber?**
   e) **At what wavelengths do single mode fibers operate? At what wavelengths do multimode fibers operate?**
   f) **What unit of measurement is used to measure the wavelength of light? Attenuation?**
   g) **Identify the spectrum of light to include the visible, infrared, short radio waves, broadcast band, long radio waves, ultra violet, x-rays, gamma rays and explains where in this spectrum fiber optic transmissions take place.**
   h) **What is the reference value for dBm measurements in optical fibers?**

Civilian Standards:

Unlike military-specified (MILSPEC) fiber optic cable and connectors, the types of fiber, connectors, and other hardware used in civilian applications are not completely standardized. Military specified fiber and connectors are usually "custom built" by manufacturers to meet the specific needs of the military. Civilian manufacturers that produce fiber optics hardware for non-military uses have no such design constraints placed upon them and therefore, produce a wide variety of hardware to be used in the fiber industry. There are, however, specific "Standards Organizations" which attempt through voluntary cooperation among fiber industry manufacturers to adopt manufacturing "Standards" for the hardware associated with fiber optics applications.

Perhaps the best-known and most widely accepted US Standards Organization for fiber hardware is the ANSI (American National Standards Institute), TIA/EIA (The Telecommunications Industry Association and the Electronic Industry Alliance). These organizations hold regular meetings with US fiber manufacturers in the attempt to reach agreement on basic fiber and connector designs and specifications. By agreeing to recognize these voluntary industry "standards" in both design and application specifications, the US fiber industry is able to produce fiber hardware, which is both less expensive to manufacture and remains compatible with existing designs.

However, it should be understood that attempts to "standardize" the fiber industry is an ongoing effort, and an especially difficult one because of the enormous changes and new technologies which have characterized the growing and evolving fiber industry to this point. As the speed of data transmission increases over fiber, new standards and new agreements must be made to take into account the changes in the manufacture of fiber hardware that make

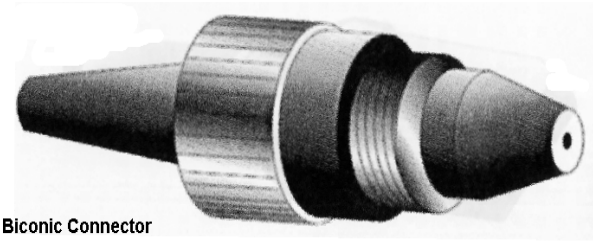
faster speeds possible. Some of the TIA/EIA Standards are: (a) The North American multimode fiber standard is 62.5/125μm (core/diameter); (b) The two recognized connector types are the ST connector and the SC connector [The TIA/EIA-568-B.3 now recognizes all types of connector styles, including Small Form Factor (SFF)]; (c) The maximum splice loss allowed is .30 dB, and (d) maximum insertion loss for connectors is .75 dB.

Each military personnel attempting **ETA®** Certification should also be familiar with the various civilian-style connectors:

SC Connector

FDDI Connector

ST Connector



Biconic Connector

Please note that while the **Biconic** connector has become somewhat obsolete within the civilian sector, its design is intrinsic to many military applications.

***NOTE:**
(Not all connector types are shown, please review course materials for additional connectors)

Civilian Codes:

There are also Codes which specify safety procedures and set building guidelines which every professional civilian installer must adhere to in the installation of fiber hardware. Various organizations publish materials and test standards and some national and local governments adopt or adhere to these standards as evidence that they are concerned with safety and quality in the construction materials. The following is a list of organizations that either publish major documents, develop certification programs for the electronics industry or are responsible for building

codes and standards: ANSI (American National Standards Institute), ASTM (American Society for Testing Materials), BOCA (Building Officials and Code Administrators), CCITT (Consultative Committee International Telegraph and Telephone), ATIS (Alliance for Telecommunications Industry Solutions), CSA (Canadian Standards Institute), ECSA (Exchange Carrier Standards Association), EIA (Electronics Industries Association), ETA CDA (The Electronics Technicians Association Certification Development Committee), ETSI (European Telecommunications Standards Institute), FCC (Federal Communications Commission), NTIS (National Technical Information Service), GSA (General Services Administration), FIPS (Federal Information Processing Standards), ICEA (Insulated Cable Engineers Association), IEC (International Electrotechnic Commission), IEEE (Institute of Electrical and Electronic Engineers), ISO (International Standards Association), AIA (American Insurance Association), NEMA (National Electrical Manufacturers Association), NFPA (National Fire Protection Association), OSHA (Occupational Safety and Health Administration), RUS (Rural Utilities Services), SBCCI (Southern Building Code Congress International, Inc.), TIA (Telecommunications Industries Association), UL (Underwriters Laboratories, Inc.), ICBO (International Conference of Building Officials), and ICAC (International Certification Accreditation Council).

The NFPA sponsors, controls and publishes the NEC (National Electrical Code) within the United States. Most federal, state and local governments have adopted the NEC, in whole or in part. The NEC encompasses the entire US jurisdictional area and specifies correct and safe procedures for the installation of fiber in new and existing buildings and dwellings in the US. The most recent version of the NEC is the 2005 Revision, and new steps and guidelines for fiber installation will be addressed in future revisions of this widely accepted code.

Color Codes for Fiber Optics:

The color code for fiber optics is as follows: Blue, Orange, Green, Brown, Slate, White, Red, Black, Yellow, Violet, Rose, and Aqua. It is common for installers to use the first letters of these colors to devise a pneumonic phrase to remember all the colors. B,O,G,B,S,W,R,B,Y,V,R, and A. A common phrase to remember is: “Boys Only Get Bigger, So Why Regret Buying Your Video Recorder Anyway?”

Color codes for single-mode and multi-mode <u>cordage:</u>

In cordage, the color “yellow” indicates singlemode fiber. Color coding helps the installer know the type of fiber he or she is dealing with without having to remove the jacketing or trace the signal source. The color code in cordage for multimode fiber is “orange” or “gray”. However, these cordage colors cannot always indicate the type of fiber contained within, as newer hybrid fiber bundles may contain **<u>both</u>** single and multimode fiber and may not correspond to current color codes. While the professional fiber optics installer should know the cordage color codes for fiber, he or she should also be aware that cordage color alone cannot always give the true indication of the type of fiber within.

Important Fiber Optic Acronyms & Terms:

The following fiber optic acronyms and technical terms are important to learn and understand in that they are frequently used as specifications for certain fiber type applications:

APC – Angled physical contact

EMI – (Electromagnetic Immunity) Fiber has electromagnetic immunity because it does not conduct electricity. The fiber is immune to the Electromagnetic Radiation Fields being expended by electrical cables.

FDDI - Fiber Distributed Data Interface

LAN - Local Area Network

LASER - “Light Amplification by Stimulated Emission of Radiation” which is coherent and near monochromatic light (lasers are typically used with singlemode fiber)

LED - Light Emitting Diode (LEDs are typically used with multimode fiber)

MAN - Metropolitan Area Network

NA - Numerical Aperture

OFCP - Optical Fiber Conductive Plenum Cable

OFCR - Optical Fiber Conductive Riser Cable

OFNP - Optical Fiber Non-conductive Plenum Cable

OFNR - Optical Fiber Non-conductive Riser Cable

OTDR - Optical Time Domain Reflectometer

PC - Physical contact.

PCM - Pulse-coded Modulation

PCS - Plastic-clad Silica

WAN - Wide Area Network

Back reflection – Light reflected from the cleaved or polished end of a fiber caused by the difference of refractive indices of air and glass. Expressed in dB relative to incident power.

Backscattering – The scattering of light in a fiber back toward the source, used to make OTDR measurements.

Bend radius - Usually the bend radius is specified for each individual cable, however, if the dynamic bend radius is not known, the generally accepted minimum bend radius is 20 times the diameter of the fiber.

Buffer (900μm) - A protective layer over fiber, such as a coating, inner jacket, or a hard tube

Cladding - The outer concentric layer of fiber that surrounds the core and has a lower index of refraction.

Coating (250μm) - A protective layer, such as an acrylic polymer, which is applied over the fiber cladding which acts as additional protection for the fiber

Core - The central, innermost, light carrying part of an optical fiber, it has an index of refraction higher than that of its surrounding cladding.

Cutoff wavelength - For singlemode fiber, the wavelength above which the fiber exhibits its singlemode operation.

dB - Decibel

dBm - Decibel referenced to a milliwatt (power measurements in fiber optics).

Composite Cable – Fiber optic cables that have a “current carrying conductor” (i.e., copper conductor) that will be used to power repeaters and/or be used for communications.

Conductive Cable – Fiber optic cables that have metal strength members (i.e., armor) for protection from rodents or direct buried in rock soil.

Hybrid Cable – Fiber Optic cables that contain two or more fiber types (i.e., singlemode and multimode, and/or singlemode tight buffer and ribbon fibers inside the same outer jacket).

Index of refraction - The ratio of the velocity of light traveling in free space to the velocity of light passing through a given material.

Modal dispersion - A dispersion of light resulting from differing transit paths of different propagating modes in a multimode optical fiber.

Mode - A possible path followed by light rays.

Multimode fiber - A type of optical fiber that can support more than one propagating mode

Pigtail - A short length of fiber (typically 3m to 30m) with a connector at one end and bare fiber on the opposite end.

Plenum cable - A cable whose flammability and smoke characteristics enable it to be routed in a plenum area without having to be enclosed in a conduit.

Singlemode fiber - An optical fiber that supports just one mode of light propagation

Splice - An interconnection method for joining the ends of two optical fibers (currently either by mechanical or fusion means).

FEE $150.00

Application for the ETA®
Fiber Optics Installer Certification Examination
(For US Military Personnel)

Instructions: **Read and review the attached "ETA® International FIBER OPTICS INSTALLER CERTIFICATION SUPPLEMENTAL STUDY PACKAGE (For U.S. Military Personnel)" and all Fiber Optics Course materials from the ETA approved fiber optics training school you have attended. Your "hands-on" skills training makes you eligible to take the 75-question knowledge examination and a passing score on the examination (75% or better) qualifies you to become certified as a Professional Fiber Optics Installer. When you are prepared to take the examination, present this form, your valid Military ID card and your Completion Certificate from an ETA® approved Fiber Optics Training School (a service jacket entry may be used in lieu of a completion certificate) to a US Military Testing Center and an examination will be ordered for you. Be sure to record the date and time you are scheduled to take the examination. You should continue to study your course materials and supplemental study package until the time of your examination, however, no study materials, books, notes, or supplemental information may be used during the examination session.**

(Print)
First Name _____ Middle Name _____ Last Name _____

Name/Rank/Present Mailing Address **Name/Rank/Permanent Mailing Address**

_____ _____

_____ _____

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_____ _____

Name of ETA Approved Fiber Optics Training School Attended _____

Applicant Signature _____

----------*Test Center Use Only*----------

Verify Valid Military ID _____ (initials) Verify Completion Certificate _____ (initials)

US Military Test Site Address _____

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Test Site Representative Name (Print) _____ Site No. _____

Test Site Representative Signature _____ Phone _____

To Request an ETA® Fiber Optics Installer Certification Exam For The Applicant, FAX this form to:
ETA®, 5 Depot Street, Greencastle, IN 46135 (765) 653-4287 FAX/Phone Number **updated 05/10/05**